

eMotions Lighting™

Model Crossing Gate and Traffic Light Controller

Model # EML1401

<u>Contents:</u>	☒ Controller Board	EML1401
	☐ Infrared LEDs and sensors	EML141R
	☐ Infrared brackets	EML14U

Features:

Controls crossing gate arms (5V Motors; DC or Servo)
 Controls crossing signal flashers (5V or 9-18V)
 Controls 2-way Traffic Signals (5V or 9-18V)
 User can change and save Traffic Signal speeds and offsets
 User can adjust the phase angle of Servo motor movement
 1 Controller detects trains entering a crossing for 1 direction
 A 2nd Controller can be connected to detect trains entering
 from 2nd direction

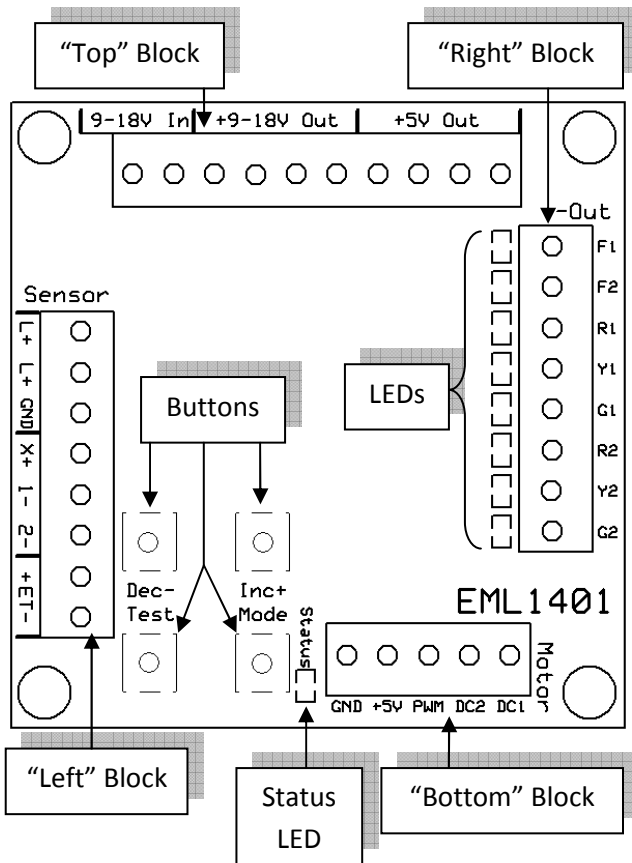
Self-resetting fuses protect at 1.1Amp up to 33V

Max. Output: 500mA for 5V devices
 1000mA for all devices (5V + 9-18V)

Requires a 9-18 Volt power supply (AC, DC or DCC)
 500mA to 1A depending on usage

This product is warrantied for workmanship and materials for ninety (90) days after purchase date. Save your receipt. Owner pays for return shipping. Warrantied product will be replaced or refurbished at the manufacturer's discretion.

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 www.emotionslighting.com
 864-404-1828



1. Connect Power Supply

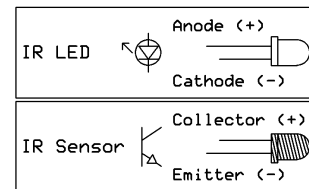
Use a 9 to 18 volt (AC, DC or DCC) power supply that matches or exceeds the current required for the lights and motors that will be connected. (500mA is sufficient for most applications.)

Connect the power supply to the terminals labeled "9-18V In" on the "Top" block of the controller. (Positive and ground wires must be separate, but can be connected to either terminal.) The controller will convert the incoming power to 9-18VDC and 5VDC. The positive outputs are also on the "Top" block. Once an active power supply is connected, the LED's on the board will illuminate.

Outputs	Maximum Current
Lights (per terminal)	500mA
DC motor(s)	500mA
Total 5 Volt devices	500mA
Total 9-18 Volt devices	1000mA
Total outputs	1000mA

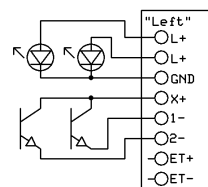
2. Connect Train Sensors

This step is required for controlling rail crossing flashers and crossing gate motors. Both pairs of IR LEDs/sensors must be used for stable results.

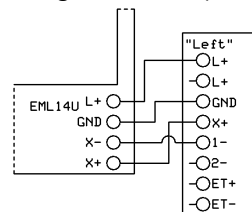


2.a Wiring

Connecting IR LEDs and IR sensors

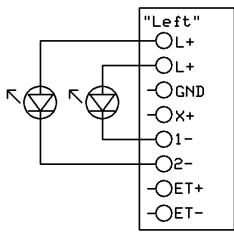


Connecting IR Brackets (EML14U)



2.a Wiring (con't)

Bypassing the IR sensors. This allows the External Trigger(ET) to work alone.



2.b Testing

In "Run" mode, the "Status" LED will provide a series of blinks to indicate the path between the IR LED and IR sensor is clear.

1 blink = 1- IR sensor sees a light source

2 blinks = 2- IR sensor sees a light source

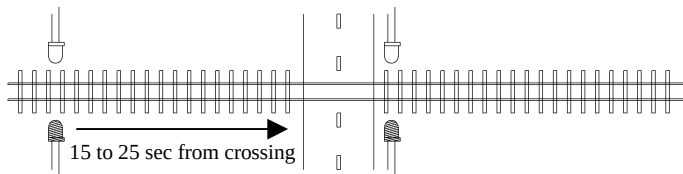
3 blinks = 1- and 2- IR sensors see a light source

The IR sensors have a dark film that only allows infrared light to activate them. However, an intense white light source positioned close to the IR sensor can also activate it.

2.c Layout Configurations

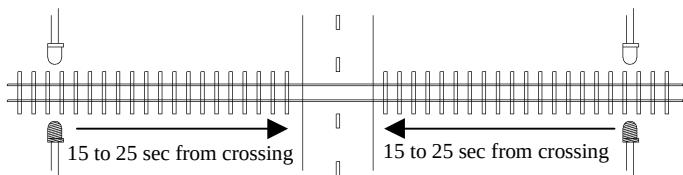
Place one IR LED and IR sensor pair 15 to 25 seconds ahead of the grade crossing. (This is the point when the flashers and arms activate.) Place the other directly behind the grade crossing. (Once this pair has been blocked and cleared for at least 0.5 seconds, the gate will rise.) The 1- and 2- terminals are interchangeable and either can be used as the first pair blocked by the train.

(Note: If a train approaches from the opposite direction, the gates will begin coming down only **after** the train is **already** in the grade crossing.)

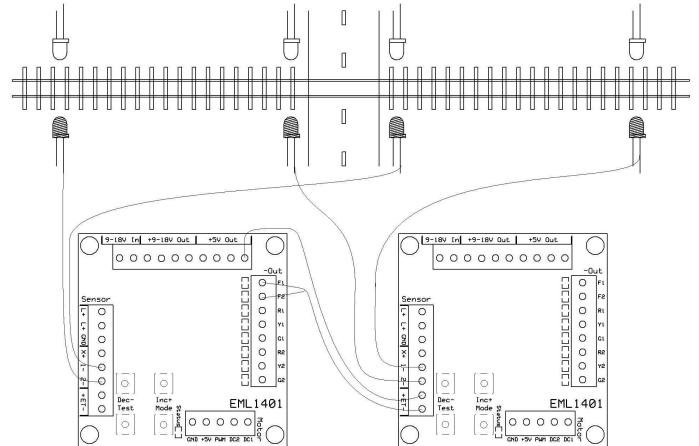


A single pair of sensors can be used for both directions.

(Note: The gate will rise after the train clears past the second sensor.)



A second (2nd) EML1401 controller using the External Trigger will detect trains coming from either direction. The gate will also begin to rise when the train exits the grade crossing from either direction.



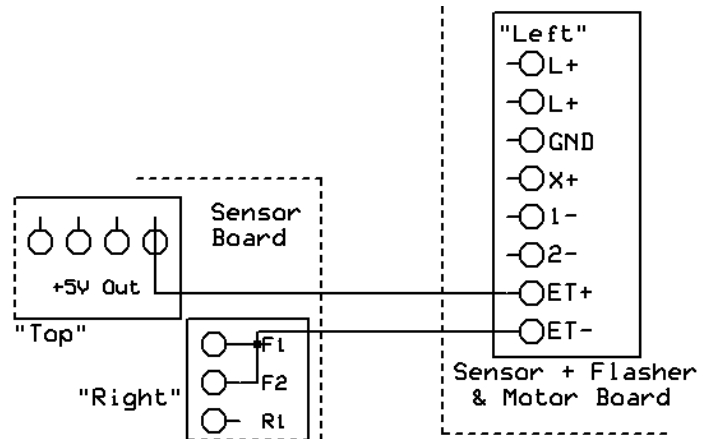
2.d External Trigger (ET)

An external trigger (ET) can be used to initiate and terminate the flashers and gate arms. This can be another EML1401 board or other switch such as a block occupancy detector. The ET is optically isolated from the rest of the board, so it will require a voltage signal to activate it. Pressing the "Test" button has same effect as activating the ET.

When the ET is activated before the IR sensors, the IR sensors will not initiate a gate action until the ET is deactivated and both IR sensors are clear. If one sensor is blocked while ET is active, the other sensor must be blocked and cleared before the sensors are ready for another train to approach.

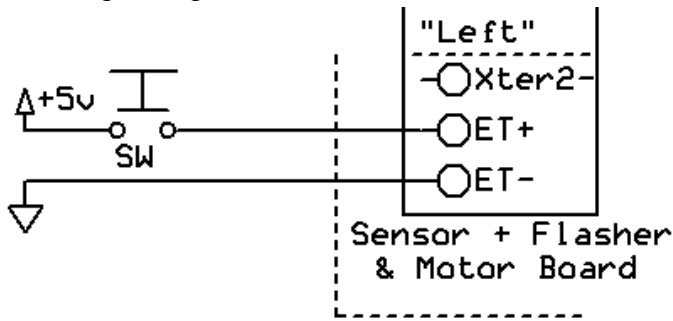
If the sensors/ET encounters an unexpected event (such as a train that backs up halfway through the crossing) the system will reset 85 seconds after the sensors are clear and the ET is off.

Connecting 2nd EML1401 to ET



2.d External Trigger (ET) (con't)

Connecting a 5V signal to ET



3. Connect the Motor(s)

3.a DC motor connection

Connect the DC motor to the "Bottom" block terminals DC1 and DC2. While the gate is rising, DC1 is +5V and DC2 is grounded. While the gate is lowering, DC2 is +5V and DC1 is grounded.

3.b PWM Servo motor connection

Connect the servo motor(s) to the "Bottom" block. Black to GND, Red to +5V and Yellow to PWM.

3.c Motor Controls

Put your controller in "Motor Setup" mode while testing and setting up motors. To do this, disconnect any External Triggers (ETs) to the board to avoid stray signals causing confusion. Press "Mode" button until the Status LED is solid and F1 & F2 LEDs are both lit. The controller is now in "Motor Setup" mode.

R1 & R2 LEDs flashing = motor is moving to gate down position. Once the motor is down, you can mechanically adjust the gate to a level position.

Pressing the "Test" button will move the motor from gate up to gate down and vice versa.

G1 & G2 on = motor has reached the gate up position. Once the motor is up: DC motors require the gate be mechanically adjusted to vertical. PWM Servo motors use the "Dec-" & "Inc+" buttons to adjust the gate to vertical.

Pressing the "Mode" button will return the controller to "Run" mode. (Status LED is off or blinking). At this time, any settings that were modified will be saved.

Refer back to this section as you setup your motor(s).

3.d Test DC motors

Press "Mode" button to put controller in "Motor Setup" mode. (Status LED is solid and F1 & F2 LEDs are both lit.)

Press the "Test" button to move the motor from up position to down position and vice versa.

R1 & R2 LEDs flashing = motor is moving to gate down position. G1 & G2 on = motor has reached the gate up position.

If the motor is going the wrong way, switch the wires going to terminals DC1 and DC2.

Press the "Mode" button to go to "Run" mode (Status LED is off or blinking). Any user settings that were altered are now saved.

3.d Test PWM Servo motors

Press "Mode" button to put controller in "Motor Setup" mode. (Status LED is solid and F1 & F2 LEDs are both lit.)

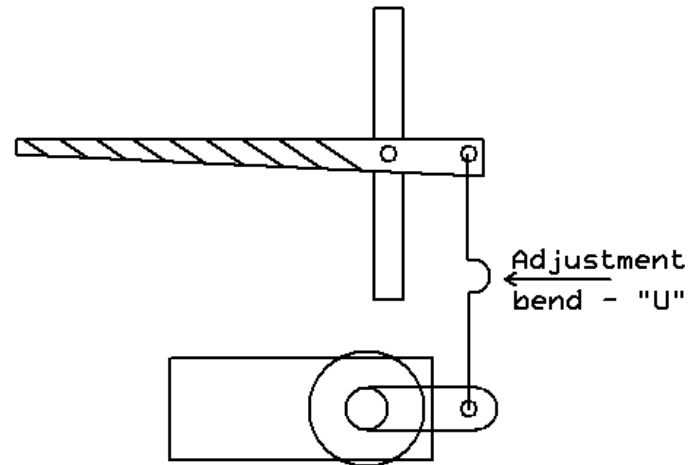
Align your motor to your crossing gate arm and press the "Test" button to move the motor from up position to down position and vice versa.

R1 & R2 LEDs flashing = motor is moving to gate down position. G1 & G2 on = motor has reached the gate up position.

Be certain that the motor is rotating the correct direction before installing. You may have to flip the motor over before installing.

If you want to adjust the motor stroke, use the "Dec-" & "Inc+" buttons while the motor is in the gate up position (G1 & G2 on).

Install the arm and motor into a frame. The linkage wire should have a small "U" in it for mechanical adjustment.



Put the motor in the gate down position (R1 & R2 flashing). You can mechanically adjust (shorten or lengthen connecting wire) the gate to a level position.

Put the motor in the gate up position (G1 & G2 on) and use the "Dec-" & "Inc+" buttons to adjust the gate to vertical.

Press the "Mode" button to go to "Run" mode (Status LED is off or blinking). Any user settings that were altered are now saved.

4. Connect Lights

4.a Decide voltages and resistor values

For the lamps you are using you must determine if they will run at 5 Volts or the 9-18 Volts of your power supply. Most incandescent bulbs will not need a resistor in series, but LEDs should have one. Typical values are:

Voltage	1 LED	Lamp
5V	100 – 500 Ω	-
9V	200 – 1000 Ω	-
18V	400 – 2000 Ω	-

4.b Connect the common

Connect all incandescent bulbs to the positive output on the “Top” block (+5V Out or +9-18V Out). LEDs will connect the same way, but make sure the anodes(+) (see diagram on pg.1) are connected to the “Top” block (+5V Out or +9-18V Out).

4.c Connect the outputs

Connect each incandescent bulb to the corresponding terminal on the “Right” block.

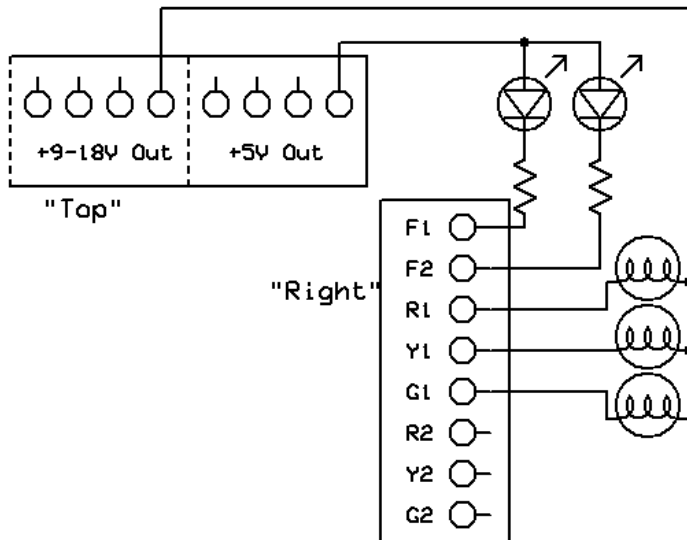
First flasher bulb goes to the F1.

The other flasher bulb goes to F2.

Red, yellow and green bulbs for traffic light 1 go to R1, Y1 & G1.

Red, yellow and green bulbs for traffic light 2 go to R2, Y2 & G2.

LEDs will connect the same way, but each cathode(-)(see diagram on pg.1) is connected to a resistor and the other end of the resistor connects to the “Right” block.



4.d Light Controls

The traffic lights are working in “Run” mode. The speed can be adjusted in “Run” mode or “Speed” mode by using the “Dec-” & “Inc+” buttons. Once a desired speed is selected, use the “Mode” button to exit the “Run” mode and then re-enter the Run” mode (Status LED is off or blinking). Any user settings that were altered are now saved. See section 5.

5. Controls Overview

5.a Selecting mode

At power up, the “Run” mode is active by default. Select other modes by pressing the “Mode” button. The Status and F1 & F2 LEDs will indicate which mode is selected”.

Mode	Status LED	F1 LED	F2 LED
Run	Off / Blinking	Off / Flashing	Off / Flashing
Speed	Solid On	Off	Off
Offset	Solid On	On	Off
Motor	Solid On	On	On

Every time the “Mode” button is pressed, the next mode is selected. When the mode is switched from “Motor” to “Run”, any user settings that were altered are saved.

5.b Run mode

In “Run” mode:

Traffic lights change according to speed and offset selected.

Sensors and External Trigger (ET) detect trains, operate flashers and crossing gate arms.

“Dec-” & “Inc+” buttons are used to change the speed of the traffic light sequence. Settings are saved by changing the mode and re-entered the “Run” mode by pressing the “Mode” button.

5.c Speed mode

In “Speed” mode:

The “Dec-” & “Inc+” buttons are used to set the speed of the traffic light cycle. Y1, G1, R2, Y2 & G2 LEDs display the speed.

Y1	G1	R2	Y2	G2	Cycle (Sec.)
On	On	On	On	On	7.0
On	On	On	On		8.8
On	On	On		On	10.6
On	On	On			12.3
On	On		On	On	14.1
On	On		On		15.8
On	On			On	17.6
On	On				19.4
On		On	On	On	22.9
On		On	On		26.4
On		On		On	29.9
On		On			33.4
On			On	On	38.7
On			On		44.0
On				On	49.3
On					54.6
	On	On	On	On	61.6
	On	On	On		68.6
	On	On		On	77.4
	On	On			86.2
	On		On	On	96.8
	On		On		107.4
	On			On	117.9
	On				130.2
		On	On	On	144.3
		On	On		158.4
		On		On	174.2
		On			191.8
			On	On	211.2
			On		232.3
				On	255.2
					281.6

5.d Offset mode

In "Offset" mode:

The "Dec-" & "Inc+" buttons are used to change the offset of the traffic light sequence. This allows multiple EML1401 to be powered up simultaneously and for the traffic lights to change at different times even if the speeds are the same.

Offset is defined as the percentage of the traffic sequence that is skipped when the unit is initially put in "Run" mode. R1, Y1, G1, R2, Y2 & G2 LEDs are used to display the offset.

R1							On
Y1						On	On
G1					On	On	On
R2				On	On	On	On
Y2			On	On	On	On	On
G2		On	On	On	On	On	On
Offset	0%	5%	9%	14%	18%	23%	27%

Once two or more boards are configured, power down the boards and start them all up simultaneously to test. Remember: before powering done to put the unit in "Run" mode to save the settings.

5.e Motor mode

Pressing the "Test" button will move the motor from gate up to gate down and vice versa.

R1 & R2 LEDs flashing = motor is moving to gate down position. Once the motor is down, you can mechanically adjust the gate to a level position.

G1 & G2 on = motor has reached the gate up position.

Once the motor is up:

DC motors require the gate be mechanically adjusted to vertical. PWM Servo motors by use the "Dec-" & "Inc+" buttons to adjust the gate to vertical.

Pressing the "Mode" button will return the controller to "Run" mode. (Status LED is off or blinking). At this time any settings that were modified will be saved.

5.f Restore Factory Defaults

Holding down the "Dec-" & "Inc+" buttons together will initiate a factory reset of all settings. It is recommended to disconnect any PWM Servos from the crossing gate arms before doing this. The factory setting for vertical may not work with your setup.

First, all LEDs will turn on. This tells you that a factory reset is about to occur.

Next, all LEDs flash. This tells you that the factory settings have been restored. Releasing the "Dec-" & "Inc+" buttons will return the unit to "Run" mode.

6. Install Sensors

To install the EML14U IR sensor brackets, drill two ½" holes that are 3 3/8" apart (center to center). For all sensors, align the IR light path at coupler level. A clear path for 0.5 seconds will trigger the gate to rise.

7. Timing

When a sensor is blocked or the External Trigger (ET) is activated, the flashers will light and an expected sequence is started. If an unexpected event (such as a 2nd sensor is not blocked within 40 seconds of the first sensor being cleared) the system will reset itself. Reset times vary but are within 85 seconds of the sensors being clear and External Trigger (ET) deactivated.

Trigger Gate Down	1st Sensor blocked	External Trigger On
Start Flash	+0 sec	+0 sec
Motors down	+2 sec	+2 sec
DC Motor stop	+12 sec	+12 sec
Trigger Gate Up	1st sensor clear 2nd sensor blocked 2nd sensor clear	External Trigger Off
Motors Up	+0 sec	+0 sec
Stop Flash	+5 sec	+5 sec
DC Motor stop	+10 sec	+10 sec
Board resets and awaits next train	Both sensors clear External Trigger off	Both sensors clear External Trigger off

8. Troubleshooting

Problem	Cause	Remedy
LEDs on board will not light.	1. Resettable fuses tripped. 2. Short in the attached devices. 3. Faulty power supply.	1. Disconnect power and reconnect. 2. Disconnect all devices and reconnect power. 3. Check that power supply is 9-18 volts.
"Status" LED blinks when IR sensors are blocked.	1. Ambient light is activating sensor. 2. Sensor is connected incorrectly.	1. Shield the sensor from other light. 2. Check that sensor is connected correctly.
Crossing gates move in wrong direction.	1. DC motor is connected wrong. 2. PWM Servo is oriented wrong.	1. Reverse the wires to DC1 and DC2. 2. Flip the PWM Motor around and re-install.
Traffic lights do not come on in the correct order.	1. Wires are connected to the wrong terminals. 2. Controller is not in "Run" mode.	1. Disconnect the lights from "Right" block and test each by attaching to ground, verify light and reattach to the "Right" block. 2. Press "Mode" button until "Status" LED is off/blinking.
Gate begins to lift when train is still blocking sensor.	1. The IR light path is clear for over 0.5 seconds in between rail cars.	1. Set the light path at coupler level to minimize the time the path is clear between rail cars.